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March 11, 2010

Mr. Richard L. Griffith, LLC
1580 Lincoln Street, Suite 700
Denver, CO 80203

Subject: Centralia BART Control Technology Analysis
Partial Response to Department of Ecology Questions

Dear Mr. Griffith:

Regarding the questions presented by the Washington Department of Ecology for the Centralia BART analysis, this letter provides responses to Questions 1 and 3. Also attached are five sets of the dimensioned general arrangement sketches requested in Question 1.

CH2M HILL continues to work on responses to remaining Ecology questions, and will forward responses when they are completed. Please contact us if you have any questions.

Sincerely,

CH2M HILL

A handwritten signature in black ink, reading "Robert L. Pearson".

Robert Pearson, Ph.D.
Vice President

Attachments:

CENTRALIA BART RESPONSES TO ECOLOGY QUESTIONS

Question 1:

To help answer questions about the 'lack of space' to install SCR, please provide scale drawings of the plant site and specific process areas, including plan and profile drawings of the boilers, the ductwork to and between the Koppers and Lodge-Cottrell ESPs, the duct work to the set scrubbers and the wet scrubbers and the new stack. The drawings need to indicate dimensions and distances, not the general arrangement of components. The drawings can cover multiple pages, must contain readable dimensions, and can be in a CAD interchange format file or equivalently detailed PDF format file instead of paper.

Response:

- A. The following drawings are attached in response to the question from the Washington Department of Ecology:

Plan and elevation general arrangement drawings from the Centralia BART report revised June 2008 depicting SCR equipment layouts, have been revised and presented to include dimensions. CH2M HILL developed sketches with proportional probable dimensions, and 11" by 17" sketches are included as an attachment.

- B. As described within the BART report, the Centralia site conditions have the potential of significantly impacting the cost estimates for all emissions control options. In general, any site condition which restricts construction activities will likely increase overall project costs. These site conditions may include space restrictions inhibiting material and equipment installation, access limitations which limit the free movement and placement of construction equipment, interferences which may require pre-construction demolition or design change considerations, operational constraints which may impact construction approach and schedule, and construction staging issues such as laydown area and employee parking availability.

Specifically for the Centralia plant, many of these site conditions are projected to significantly contribute to increased project costs for any construction activities. In large part due to previous environmental retrofit installations at Centralia, the available space for new equipment installation at the Centralia plant site is very limited. This limitation resulted in the consideration of locating a potential SCR installation over existing electrostatic precipitators, instead of being located closer to the boiler in order to minimize cost. Restricted site area may also impact costs for longer duct work runs and remotely located ancillary equipment.

Question 3:

Ecology has requested details of the SCR cost analysis produced by CH2M-Hill, specifically the analysis contained in the July, 2008 analysis. Specific issues with the cost analysis:

- *Explanation of all cost elements in the CH2M [sic] cost estimating spreadsheet, including discussion of differences on specific cost elements from the EPA Control Cost Manual defaults, especially the cost items not explicitly included in the EPA Control Cost Manual.*

The summary table below compares the specific cost elements of the CH2M HILL SCR capital cost estimate with the default values from the EPA Air Pollution Control Cost Manual. Table A is intended as a response to the Ecology request.

The cost estimating equations in Section 4.2, Chapter 2 “Selective Catalytic Reduction” of the EPA Air Pollution Control Cost Manual are based on equations developed by The Cadmus Group, Bechtel Power and SAIC in 1998 and follow the costing methodology of EPRI. CH2M HILL used alternative estimating methodologies which have extensively been utilized to develop budgetary cost estimates for utility power and air pollution control projects.

The EPA Cost Manual methodology is generally applicable for new or existing sources, and allows inclusion of unique site-specific retrofit or lost generation costs. It should be noted that at a “study” level estimate of +/- 30% accuracy, the Manual states that “a retrofit factor of as much as 50 percent can be justified”. Therefore, it is difficult to make a direct comparison of all of the cost elements, since the two methodologies breakdown costs differently.

Because the EPA Cost Manual contains default values which are provided for a range of general applications, CH2M HILL considers the estimating methodology utilized for the Centralia BART analysis to be more accurate since specific site information and conditions were considered. In addition, current vendor cost information was utilized in developing the estimates.

TABLE A
Economic Analysis Summary for Both Units 1 and 2
CPP

Parameter	SCR		
NO _x Emission Control System	SCR		
SO ₂ Emission Control System	Forced Oxidation Limestone Scrubber		
PM Emission Control System	Dual ESPs		
CAPITAL COST COMPONENT	Cost	CH2M HILL Basis	EPA Control Cost Manual Basis
Major Materials Design and Supply (\$)	277,685,000	CH2M HILL factored estimate	EPA control cost manual
Eng, Startup, & Indirect (\$)	57,500,000	CH2M HILL factored estimate	20% of total direct capital costs
Total Indirect Installation Costs (TIIC)	335,185,000		
Contingency (\$)	50,277,750	15% of total indirect installation costs	15% of total indirect installation costs
Sales Tax (\$)	26,814,800	8% of total indirect installation costs	Included in total direct capital costs
Plant Cost (PC)	412,277,550		
Margin (\$)	41,227,755	10% of plant cost	No margin
Total Plant Cost (TPC)	453,505,305		Includes 2% of total plant cost, AFUDC and cost to store 29 wt% aqueous ammonia for 14 days
Owner's Costs (\$)	45,350,531	10% of total plant cost	No owners costs
Allows for funds during construction (AFUDC) (\$)	54,420,637	12% of total plant cost	No AFUDC
Lost Generation (\$)	27,014,400	Calculated at \$20/MW-hr and 42 days	
TOTAL INSTALLED CAPITAL COST (\$)	580,290,872		
FIRST YEAR O&M COST (\$)			
Operating Labor (\$)	351,250	CH2M HILL estimate	Assumed none required for SCR
Maintenance Material (\$)	702,500	CH2M HILL estimate	Combined with maintenance labor, 1.5 % of total capital cost
Maintenance Labor (\$)	351,250	CH2M HILL estimate	
Administrative Labor (\$)	0		
TOTAL FIXED O&M COST	1,405,000		
Reagent Cost	1,783,475	Anhydrous ammonia at \$0.20/lb	Anhydrous ammonia at \$0.058/lb
SCR Catalyst	2,107,500	Catalyst cost estimated at \$3000/m ³	Catalyst cost at \$85/ft ³
Electric Power Cost	2,403,603	Power cost estimated at \$50/MW-hr	Power cost at \$0.05/kW-hr, 1795 kW
TOTAL VARIABLE O&M COST	6,294,577		
TOTAL FIRST YEAR O&M COST	7,699,577		
FIRST YEAR DEBT SERVICE (\$)	63,712,819	Calculated using 7% annual interest rate for 15 years	Calculated using 7% annual interest rate for 15 years
TOTAL FIRST YEAR COST (\$)	71,412,396		
Power Consumption (MW)	7.03		
Annual Power Usage (kW-Hr/Yr)	48.1		
CONTROL COST (\$/Ton Removed)			
NO_x Removal Rate (%)	72.0%		
NO_x Removed (Tons/Yr)	7,855		
First Year Average Control Cost (\$/Ton NO_x Rem.)	9,091		

- *Basis of 16% multiplier in the calculations*

We assume that Ecology is referring to the 15% Project Contingency in the SCR cost estimate. When developing a cost estimate, there is always an element of uncertainty since costs are based upon several assumptions and variables. Contingency provides an amount added to an estimate, which covers project uncertainties and added costs which experience dictates will likely occur. The magnitude of the contingency used in the CH2M HILL cost estimate is typical of contingency utilized in similar budgetary estimates, and matches the default 15% Project Contingency shown in Table 2.5 “Capital Cost Factors for an SCR Application” on page 2-44 of Section 4.2, Chapter 2 of the EPA Air Pollution Control Cost Manual, Sixth Edition.

- *Sources of 'vender quotes' referenced in the CH2M HILL documents*

The cost estimates were developed as “budgetary estimates”, therefore CH2M HILL did not use vendor quotes for the SCR cost estimate. A factored approach was utilized for the determining the SCR capital cost which utilized in-house cost information, and consists of compilation of vendor and previous project information.

- *Whether any structural analyses were done in support of SCR cost analysis and the results of the analyses*

Detailed structural analyses were not performed for the SCR cost analysis. However, a cursory review of structural requirements was completed to locate the SCR reactor and ductwork. CH2M HILL assumed a separate structure for the SCR reactor and ductwork because the existing ESP structure was not designed for these additional loads.